

CLAIMS

SUBA' 5 1. A method for fine frequency-offset error determination in a radio receiver, comprising the steps of:

sampling an OFDM radio transmission;

assuming a coarse frequency offset after compensation by a previous circuit that will not exceed approximately ± 10 kHz; and

10 using a cost function to determine a fine-frequency offset of said OFDM radio transmission for use in a subsequent circuit providing for frequency compensation of any fine-frequency offset.

15 2. The method of Claim 1, further comprising the step of:

determining a coarse frequency offset of said OFDM radio transmission.

20 3. The method of Claim 1, further comprising the step of:

compensating any coarse frequency offset determined in a previous step to at worst approximately ± 10 kHz.

25 4. The method of Claim 1, further comprising the step of:

finding a timing reference boundary between a short preamble and said long preamble in said OFDM radio transmission.

5. The method of Claim 1, wherein the step of using a cost function

generally conforms to $C(\hat{v}) = |V_0 X_{\hat{v}}|^2 = \left| \sum_{n=0}^{63} x(n) e^{-j 2\pi \frac{v}{F_s} n} \right|^2$.

30 6. The method of Claim 1, wherein the step of sampling is such that said signal subspace is spanned by a set of 52 row vectors derived from a 64×64 square matrix associated with a 64-element discrete Fourier transform wherein said non-signal subspace is spanned by a set of 12 row vectors also derived from the 64×64 square matrix associated with the 64-

element discrete Fourier transform and wherein two of these vectors are real,

7. The method of Claim 1, wherein the step of sampling is such said
5 OFDM radio transmission is typically measured in 16-bit I/Q samples every 0.05 μ S, and overall can be mathematically modeled as,

$$x(n) = A(n)e^{j\Phi(n) + j2\pi \frac{\nu}{F_s} n + j\varphi} + \eta(n)$$

10 where,

$\Phi(n)$: long preamble phase

ν : residual frequency offset

φ : phase offset

$\eta(n)$: additive white Gaussian noise (AWGN)

8. A method for fine frequency-offset error determination in a radio
15 receiver, comprising the steps of:

sampling an OFDM radio transmission, wherein fifty-two non-zero
equal magnitude subcarrier measurements are obtained that collectively
represent a reference signal comprising a signal subspace and a non-signal
subspace, and is such said OFDM radio transmission is typically measured
20 in 16-bit I/Q samples every 0.05 μ S, and overall can be mathematically modeled as,

$$x(n) = A(n)e^{j\Phi(n) + j2\pi \frac{\nu}{F_s} n + j\varphi} + \eta(n)$$

25 where,

$\Phi(n)$: long preamble phase

ν : residual frequency offset

φ : phase offset

$\eta(n)$: additive white Gaussian noise (AWGN)

determining a coarse frequency offset of said OFDM radio transmission;

compensating any coarse frequency offset determined in a previous step to at worst approximately ± 10 kHz;

5 finding a timing reference boundary between a short preamble and said long preamble in said OFDM radio transmission;

assuming a coarse frequency offset after compensation by a previous circuit will not exceed approximately ± 10 kHz; and

10 using a cost function to determine a fine-frequency offset of said OFDM radio transmission for use in a subsequent circuit providing for frequency compensation of any fine-frequency offset, wherein said cost

function generally conforms to $C(\hat{\nu}) = |V_0 X_{\hat{\nu}}|^2 = \left| \sum_{n=0}^{63} x(n) e^{-j 2\pi \frac{\hat{\nu}}{F_s} n} \right|^2$.

15 9. The method of Claim 1, wherein the step of sampling is such that said signal subspace is spanned by a set of 52 row vectors derived from the 64×64 square matrix associated with the 64-element discrete Fourier transform wherein said non-signal subspace is spanned by a set of 12 row
20 vectors also derived from the 64×64 square matrix associated with the 64-element discrete Fourier transform and wherein two of these vectors are real,